

NOVEMBER/DECEMBER 2025

23PMA34 — MECHANICS

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define virtual displacement.
2. Write any two examples of workless constraints.
3. Define Natural Systems.
4. Write the standard form of Lagrange's equation for a holonomic system.
5. State Hamilton's principle.
6. Define the stationary values of a function.
7. Define the characteristics function.
8. Define Hamilton's principal function.
9. Define canonical transformation.
10. State the Poisson's theorem.



SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Describe the non-holonomic constraints with suitable example.

Or

- (b) Explain the potential energy in detail.

12. (a) Obtain the Jacobi integral of motion.

Or

- (b) Discuss about conservative systems.

13. (a) A particle of mass m is attracted to a fixed point O by an inverse square force $F_r = \frac{-\mu m}{r^2}$. Using the plane polar coordinates to describe the position of the particle, find the equations of motion.

Or

- (b) Explain modified Hamilton's Principle.

14. (a) State and prove Jacobi's theorem.

Or

- (b) Discuss about the Hamilton's Principal function.

15. (a) Use the Poisson bracket to show that the transformation $Q = \sqrt{e^{-2q} - p^2}$, $P = \cos^{-1}(Pe^q)$ is canonical.

Or

- (b) Explain the principal forms of generating functions.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Explain the kinetic energy of a system in detail.
17. Derive Lagrange's equation for a holonomic system.
18. Describe the Brachistochrone problem.
19. Derive the Hamilton-Jacobi equation.
20. Explain Lagrange's brackets.